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REAL ESTATE DEVELOPERS INSIGHT ON THE CRITICAL BARRIERS TO SUSTAINABLE HOUSING DELIVERY

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Abstract

Sustainability has been advocated in the housing sector in developing nations but its adoption is hampered with myriads of barriers. This study investigates the critical impediments to sustainable housing delivery.

To achieve this, 18 commonly used barriers in existing literature were selected for investigation in this study. Structured questionnaires were administered to 91 housing developers within metropolitan Lagos, Nigeria and analyzed using both weighted mean and factor analysis.

The ranking and normalization analysis showed that out of these investigated barriers, deficiency in government motivations for sustainable housing, non-existence of sustainability enforcement and the absence of information on the sustainable building technologies database were the topmost three critical challenges to sustainable housing delivery. The factor analysis also showed that the underlying factor groupings of the critical barriers can be classified into technology and cost, knowledge and awareness, policy implementation, client and economic related barriers.

These research findings have added to the sustainable housing literature within the context of Nigeria. They also create a reliable blueprint which would assist all stakeholders in taking the sustainable approach to ameliorate these impediments, thus promoting sustainability attainment in housing delivery.

Key words: *adoption, barriers, developing nations, housing delivery, sustainability.*

JEL Classification: *Q01, R31.*

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1. Introduction

The housing industry, a major sector of the construction industry, is generally agreed to have a harmful but good impact on the social, environmental and economic components of a nation. Chan et al., (2016) revealed that, in most developed and developing countries, construction-related activities (housing development inclusive) consume products comprising of 70% cement and 25% steel. This connotes that the industry is noted for its high level of resource consumption over the years. Although, Maliene and Malys (2009) submitted that the delivery of housing should reduce greenhouse gas emissions, ensure effective resources usage and enhance GDP, this has sadly not been the case over the years. To avert this abnormality, effort has been directed towards the adoption of sustainable development in the housing industry (Chan et al., 2016).

Sustainable development, according to Oyebanji et al., (2017), is one which meets the needs of the present age without compromising that of the future. As regards the promotion of sustainability in the housing industry around the world, the government has advocated for green buildings as a measure of attaining sustainability (Chan et al., 2016; Shen et al., 2017). In the present study, green building and sustainable housing are used interchangeably to mean the same thing. Sustainable housing seeks to meet the economic, environmental and social goals of housing development (Ilesanmi, 2010). It is a home designed against hazards to meet people's preferences (Golubchikov & Badyina, 2012). The adoption of sustainable development in the housing industry offers huge benefits to the environment, economy and society; these are not derivable from traditional approaches to housing delivery. Roshanfekr et al. (2016) expressed that most of the perceived benefits of sustainable housing include safety and security, accessibility, affordability for low-income earners, minimal negative effects on buildings, occupants and the environment. Darko et al., (2018) and Chua and Oh (2011) further revealed that going green and sustainable during housing delivery often leads to a reduction in life cycle cost, saves energy, enhances health and comfort, improves productivity, promotes a strong green economy and industry, increases a country's performance and helps protect the environment. Accordingly, Chan et al., (2016) submitted that, as a result of the benefits inherent in sustainable housing delivery in recent decades, its adoption in most nations is very important.

Despite the numerous benefits inherent in sustainable housing delivery, its adoption and enforcement are bedevilled with a myriad of challenges and barriers, especially in countries which are still in their infancy state when it comes to sustainability. Mao et al., (2015) and Chan et al., (2016) further reiterated that the implementation and adoption of sustainable housing is not free of barriers and challenges. Similarly, when it comes to integrating sustainability into housing delivery, there exist various impediments which may hamper implementation (Muhammad et al., 2015). Despite the advantages of sustainable housing, the paradigm shift towards sustainability has been problematic due to its many barriers (Adabre & Chan, 2019). These barriers exist due to the intricacies and level of inconsistent significances in the housing sector (Abraham & Gundimeda, 2018). The lack of understanding and fuzziness of the dimensions present an issue in the implementation of sustainable housing in developing countries. Less attention has been given to sustainable housing delivery barriers in developing countries, especially in Nigeria where there is little encouragement towards sustainable development goals related to housing (Ibem et al., 2015). Dahiru et al. (2013) argued that various elements are still impeding the reality of sustainable housing delivery in Nigeria, as there is no framework to support its implementation. The identification of and addressing various barriers to sustainability attainment is, therefore, very important to ensure effective implementation and practices in the housing industry (Mao et al., 2015). This is essential in Nigeria among other developing countries, which is still at an immature stage of sustainable housing delivery (Adabre & Chan, 2019).

Arising from this background, the study seeks to examine the barriers to sustainability attainment in housing delivery using the factor analytical approach. The study focuses on Lagos State, a city in the Southwestern part of Nigeria, which is the western part of Africa. The outcome of this present study will be an eye opener on barriers to achieving sustainability in the developing nations. It will also establish a basis to assist policy makers, developers and the government in taking measures to mitigate the barriers to promoting sustainable attainment in the housing sector. This paper has five sections. The first section contains the introductory background for the study. In Section 2, a review of extant literatures regarding the barriers to sustainable housing delivery is discussed. Section 3 provides the details behind the methodology used for the study, whereas Section 4 presents the

results of the analysis. The final section is dedicated to the conclusion of the study.

2. Literature Review

The adoption, implementation and promotion of green building technologies have long been regarded as solutions to attaining sustainability in the built environment. However, there have been reports regarding the barriers impeding sustainable housing delivery in the construction industry; these are specific to developed and developing countries. For instance, in developed nations, Williams and Dair (2007) revealed that the lack of professionals, inadequate consciousness and information, lack of sustainable resources and materials, the high cost of sustainable housing and poor demand from clients are the five critical barriers to sustainable housing development in England. Karji et al., (2020), in the United States of America, investigated the barriers to sustainability promotion in the construction industry. A principal components analysis was employed for data analysis and barriers critical to sustainability promotion were found to include preconstruction, managerial, legislative, planning and financial ones. Also, in the United States of America, Chan et al., (2016) observed that inadequate awareness and knowledge, lack of proficient expert, poor government incentives and motivations, logistic barriers in importing the needed technology and a hike in the cost of technology hamper the adoption of green building technology for the promotion of sustainable housing. Winston's (2010) study on the barriers against sustainability attainment in housing development conducted in Ireland reported that the lack of housing regulations, unavailability of professionals and inadequate information are the significant barriers militating sustainable housing. Rodriguez Nik et al., (2015) and Meryman and Silman, (2004), who carried out research in the USA, concluded that the lack of required skills and nonchalant attitude of the government are all issues that green building development must confront.

A study by Adabre et al., (2020) on the critical barriers to sustainability attainment in affordable housing revealed that related barriers, such as land market, incentive, housing market, green retrofit and infrastructure, are among the categories of critical barriers to sustainability attainment in affordable housing. Alam et al., (2019) submitted that a delay in planning processes and approvals by the government are the major barriers to attaining housing sustainability in Australia. Love et al., (2012) in Chan et al., (2018) showed that the dearth of building regulations and codes, poor information and knowledge, inexperienced developers and a lack of government support are the main barriers that green building technology adoption for the promotion of sustainable housing in Australia must overcome. Bond (2011) in Chan et al., (2018) also stated that inadequate information on sustainable principles is a major barrier to sustainability attainment in New Zealand and Australia. In Hong Kong and Singapore (Chan et al., 2009), on the other hand, critical barriers in way of green building development were found to include comprised education on sustainability, inadequate incentives and a lack of public awareness.

Abraham and Gundimeda (2018) quantitatively identify, rank and prioritize the barriers to the adoption of green building using the Analytic Hierarchy Process (AHP) in India. Twenty specific barriers were observed and classified into: policy and market barriers; financial and economic barriers; information, promotion and education barriers; and managerial and organizational barriers. Hasan and Zhang (2016) as well as Mao et al., (2015) investigated the impediments to green housing and implementation the promotion of sustainability in China, and discovered that the exorbitant cost of sustainable materials, clients' unwillingness to bare additional costs, the lack of a green building database and the lack of required technology are the major barriers preventing the implementation of green construction. Saleh and Alalouch (2015), while investigating the challenging factors to sustainable housing and construction in Oman, concluded that the implementation of sustainable housing and construction is plagued with barriers such as: inadequate sustainable building ingredients, a lack of awareness and knowledge, and inappropriate government legislation. The study further asserted that nearly all projects that are sustainable take a longer time to complete with diverse bottlenecks involved, thereby hindering the promotion and development of sustainable housing in Oman.

In Malaysia, which serves as a good example of a developing economy, the barriers impeding sustainable housing delivery include the lack of knowledge and education on sustainability, the lack of client's demand, poor organizational commitment to sustainability, the lack of a green building database and cost implications (Shari & Soebarto, 2012). Syed Jamaludin et al. (2017) conducted a study on the challenges of integrating sustainable and affordable housing in Malaysia, claiming that

the barriers impeding sustainable housing could be classified as expertise, market, technological and societal barriers. Zainul Abidin et al., (2013) and Abidin (2010) also concluded that poor implementation of sustainability programs, inadequate government incentives, a shortage of locally produced technology, as well as poor knowledge and expertise are the threats posed to sustainable housing and construction in Malaysia.

Enshassi and Mayer (2005) also presented the barriers to sustainable housing development in Palestine, including inadequate knowledge on sustainability, the lack of training among developers, the lack of sustainable regulations, poor incentives and financial challenges, the lack of public awareness, resistance to change, funders failure to implement novel technology, the lack of a databank, anxiety regarding increased costs and the lack of sustainability culture. Agyemang and Morrison (2018) in Dublin claim that the lack of enforcement of the planning control system on development, ineffective sustainable housing guidelines, and a contradictory policy between local and central authorities are the barriers to sustainable, affordable housing. Czischke and van Bortel (2018) noted that inadequate policies and sustainability practice guidelines are the major barriers to sustainable housing promotion

In Ghana, while studying the barriers to the adoption of a green building approach to promoting sustainable housing development, Chan et al., (2018) found that the lack of mortgage finance for housing development, expensive green building technologies and poor governmental incentives are the most critical impediments. In Sub-Saharan Africa, Sulemana et al., (2019) concluded that inequality is a major barrier to attaining sustainable housing affordability. In Burkina faso, Nikyema and Blouin (2020) explored the barriers to green building technology adoption and posit that government, human-related, knowledge, market, and cost and risk barriers are the most profound challenges to green building adoption. Olanipekun (2015), while exploring the barriers to developing sustainable properties in Lagos, Nigeria, found that the lack of requisite knowledge in sustainable property development and inadequate finances are paramount. Muhammad et al., (2015) also found that the lack of concern for low-income residents during development is a major challenge in sustainable housing delivery in Abuja, Nigeria. Akinshipe et al., (2019) attest that the major constraints to sustainable construction in Ondo State, Nigeria were an inadequate knowledge of sustainable development in the adoption of new procurement methods, a shortage of professionals in the sustainability sector and the lack of interest among developers and clients.

3. Methodology

3.1. Data collection approach

Based on a literature review, the 18 most commonly arising barriers to sustainable housing delivery in existing literature were selected and applied to this study. The selection of these barriers is based on the premise that they are common themes in previous papers. The study adopted a quantitative research design to evaluate the barriers against sustainable housing delivery. Primary data for the research were collected via questionnaire surveys. The target population are members of Real Estate Developers Association of Nigeria (REDAN) in Lagos, Nigeria. These respondents were selected because of their official recognition by the Federal Government of Nigeria since 2002 as an organized private and public sector responsible for housing development within the country. The barriers were written out in questionnaire form and the opinion of the respondents sought in order to achieve the goal of the research. Prior to the administration of the questionnaire, its variables were validated by built environment academic professionals from the University of Benin, Nigeria so as to eliminate ambiguity, ensure rationality and ascertain the criticality of the barriers when applied to the Nigerian property market. The questionnaire was divided into two parts. Part A focused on information regarding the respondents' background. This is imperative to ascertain the credibility of the responses obtained for data analysis. Part B of the questionnaire highlighted the barriers on a five-point Likert scale (*5=very critical …1=not critical)*. Table 1 presents the demographics of the respondents.

3.2. Data analysis method

3.2.1. Cronbach's alpha approach

Before conducting any statistical analysis on the collected data, the items in the questionnaire and its

reliability were assessed to ascertain the construct being measured. The Cronbach's alpha coefficient of the barriers was 0.789, which was higher than the threshold of 0.70 (Robinson et al. 1991), indicating good internal consistency and that the correct construct is being measured by the questionnaire, and thus, further analysis can be embarked on.

Table 1

Demographics of respondents

Category	Characteristics	Frequency	Percentage
Educational status	National Diploma	9	12.16
	Higher National Diploma	14	18.91
	B.Sc/B.Tech	27	36.49
	M.Sc/M.Tech	15	20.27
	Ph.D	6	8.10
	Other qualifications	3	4.05
	Total	***74***	***100.0***
Years of professional practice	1 - 5 years	27	36.49
	6-10years	31	41.89
	11-15 years	9	12.16
	Over 20 years	7	9.45
	Total	***74***	***100.00***
Years of experience in sustainable housing provision	> 2 Years	10	13.52
	2- 4 Years	17	22.97
	4-6years	25	33.78
	Over 6 years	22	29.73
	Total	***74***	***100.00***

Source: own study.

3.2.2. Mean score analysis

This is a quantitative analysis technique used to prioritize the level of significance of the variables. In this study, the mean score analysis was adopted to ascertain the relative priorities attributed to the barriers in way of sustainable housing delivery. The mean values were then normalized in order to indicate the critical barriers.

3.2.3. Factor analysis method

In this study, the suitability of factor analysis was determined by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. The KMO Measures the adequacy of the sample by comparing the partial correlation coefficient size. The value of KMO ranges from 0 to 1. A value close to 0 shows that the sum of the partial correlation is large as compared to the sum of the correlations, hence factor analysis would not be suitable, as there exists a discrepancy in the pattern of correlations. In the same vein, the closer the value is to 1 the higher the correlation pattern; hence, factor analysis would be suitable as it would yield credible and discrete factors (Olawumi & Chan, 2019). Also, the KMO value must be >0.50 over the threshold before the data can be considered suitable for factor analysis. The Barlett's test of Sphericity was carried out to determine the degree of correlation among the set of factors. This is used to assess whether or not the original correlation matrix is an identity matrix (Chan et al., 2018). Factor analysis would be appropriate when Barlett's test statistics is large and the associated level of significance is small; hence the population correlation matrix is not an identity matrix (Pett et al., 2003)

For the purpose of clarity, the critical barriers were first subjected to a normalization technique before carrying out factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was 0.704, which is higher than the benchmark of 0.60 suggested by Netemeyer et al. (2003). This implies that the degree of common variance among the selected barriers is relatively high. Also, Barlett's sphericity Chi-square value is 357.130 and with a significant level of 0.00, suggesting that relationships among the barriers exist. To further confirm the appropriateness of factor analysis for this study, the set of variable were investigated. Darko et al., (2019) claimed that, with communalities

of all variables ≥0.60, sample size below 100 is appropriate for factor analysis. The communalities for the study were above 0.60 suggesting the appropriateness of the sample for factor analysis.

4. Results

This section presents the results of the present study. The findings are presented using both the mean score and factor analytical approach to show the critical barriers to the implementation, promotion and adoption of sustainable housing delivery in Lagos Nigeria.

Table 2

Normalization analysis of the barriers to housing delivery sustainability attainment

S/N	Barriers	Mean	S.D	Normalization [c]	Rank
1	Inadequate government participation and incentive	4.20	.891	1.000[c]	1st
2	Lack of sustainability enforcement	4.08	.736	0.933[c]	2nd
3	Lack of information on sustainable building technologies database	4.07	.689	0.927[c]	3rd
4	Logistics involved in importing the needed technologies	4.01	.884	0.893[c]	4th
5	Limited understanding of usage of traditional non-procurement methods	3.77	.673	0.758[c]	5th
6	Inaccessible sustainable housing delivery guidelines and methods	3.76	1.451	0.753[c]	6th
7	Lack of organization commitment	3.73	1.102	0.736[c]	7th
8	Lack of education and training on sustainability	3.72	1.485	0.730[c]	8th
9	Lack of awareness regarding sustainable building	3.69	1.313	0.713[c]	9th
10	Unwillingness to bare additional construction costs	3.66	1.089	0.697[c]	10th
11	Lack of sustainable housing regulations and codes	3.66	1.446	0.697[c]	11th
12	Unfamiliarity of developers with sustainable housing technologies	3.64	1.410	0.685[c]	12th
13	Lack of a demonstrated housing project	3.53	1.306	0.624[c]	13th
14	Lack of financing programs for sustainable housing	3.51	1.285	0.612[c]	14th
15	High cost of developing sustainable housing	3.46	1.196	0.584[c]	15th
16	Hike in the cost of importing required technologies	3.43	1.405	0.567[c]	16th
17	Fear and risk involved in the adoption of new technologies	3.39	1.383	0.545[c]	17th
18	Lack of clients' interests	3.38	1.342	0.539[c]	18th

SD= Standard deviation, Normalization = (Actual mean – min. mean)/(max. mean – min. mean)
c= critical barriers with normalized value ≥0.05

Source: own study.

Table 2 depicts the mean score for the barriers to sustainable housing delivery. From the Table, the mean values range from 4.20 (inadequate participation and incentive) to 3.38 (lack of clients' interests). These barriers with their normalized value ≥ 0.5, adopting the cut-off point put forward by Adabre and Chan (2019) and Xu et al., (2010), are considered critical for attaining the delivery of sustainable housing . The lack of government participation and incentive ranked first as the most critical barrier to achieving sustainable housing delivery in Lagos, Nigeria. This was supported by the view of Chan et al. (2016), Rodriguez-Nik et al. (2015), Love et al., (2012), Meryman and Silman (2004), where it was asserted that, with poor incentive from the government and lack of government participation and

support, sustainable housing provision will not see the light of the day. This finding could be attributed to the fact that the economy of Nigeria is solely dictated by the government. Other top critical barriers include the lack of government enforcement, which ranked 2nd (mean = 4.08), the lack of information on sustainable building technologies ranked 3rd (mean = 4.07), logistics involved in importing the required technologies, which ranked 4th (mean = 4.10), and the limited knowledge on the use of a traditional non-procurement method, ranking 5th, with a mean value of 3.77. These 18 barriers were then adopted for the factor analytical approach in Table 3.

Table 3

Factor analysis results of the critical barriers against sustainable housing delivery

Cluster groupings	Communalities	Factor loadings	Eigen values (%)	Variance (%)
Factor 1: Technology and cost related barrier				
Developers unfamiliarity with sustainable housing technologies	0.682	0.800	4.348	24.156
High cost of developing sustainable housing	0.668	0.660		
Hike in cost of importing required technologies	0.622	0.625		
Lack of financing programs	0.687	0.616		
Factor 2: Knowledge and awareness related barrier			1.937	10.762
Lack of education and training on sustainability	0.690	0.800		
Inaccessible sustainable housing delivery guidelines and methods	0.612	0.601		
Limited understanding on usage of traditional non-procurement methods	0.709	0.558		
Lack awareness of sustainable housing	0.634	0.551		
Factor 3: Policy implementation related barrier			1.607	8.928
Lack of information on sustainable building technologies data bases	0.651	0.768		
Lack of sustainability enforcement	0.600	0.716		
Lack of organization commitment	0.794	0.564		
Lack of sustainable housing regulations and codes	0.611	0.506		
Factor 4: Fear and risk related barrier			1.378	7.658
Fear and risk involved in new technologies adoption and implementation	0.823	0.877		
Lack of demonstrated housing project	0.828	0.798		
Factor 5: Client related barrier			1.165	6.470
Unwillingness to pay additional construction cost	0.652	0.780		
Lack of clients' interests	0.698	0.721		
Factor 6: Economic related barrier			1.104	6.132
Logistic involved in importing the needed technologies	0.728	0.827		
Inadequate government participation and incentive	0.601	0.565		
Total variance				**67.505**

Extraction method: Principal Component Analysis; Rotation method: Varimax with Kaiser Normalization.

Source: own study.

Factor extraction was conducted using principal component analysis. The eigen value measures the contribution of each group of barriers to the principal components. The Varimax rotation of the 18 critical barriers resulted in six underlying components as presented in Table 3, and explains 67.505% of the total variance. Also, to ascertain the variables to be included in the factor analysis, Akintoye (2000) argued that variable factor loading close to or above 0.50 should be retained. Therefore, since all the variables in Table 3 have a factor loading above 0.50 implying their level of significance and

contribution to the interpretation of the components, they were all retained for the analysis. The factors were grouped into 6 classes and given appropriate nomenclature. The barriers are classified into *technology and cost, knowledge and awareness, policy implementation, fear and risk, client and economic related barriers*.

Factor 1 - Technology and cost barrier

Factor 1 encompasses four underlying barriers which are unfamiliarity of developers with sustainable housing technologies, high cost of developing sustainable housing, a hike in the cost of importing the required technologies and a lack of financing programs. All these barriers are closely tied to technology and cost-related issues affecting sustainable housing delivery. This group has 24.156% of variance explained which is the highest of the 6-underlying groups. This implies that, from a statistical point of view, technological and cost barriers are the most dominant barrier against sustainable housing delivery in Lagos Nigeria. Unfamiliarity of developers with sustainable housing technologies is a critical barrier against sustainable housing delivery as indicated in Table 2. Darko et al., (2018) argued that the promotion of sustainable housing is a function of the level of familiarity of the developers on the appropriate technologies.

This barrier confirms the infancy state of sustainable housing delivery in Nigeria as developers are yet to become familiar with the new technologies available for sustainable housing delivery leading to their adherence to traditional approaches. Therefore, developer's unfamiliarity could be attributed to the absence of required technology to promote sustainable housing delivery in the Nigeria construction industry thus leading to developers evading sustainable technologies. The findings of this present study are in agreement with those of Syed Jamaludin et al. (2017), where it was affirmed that inappropriate familiarity of developers with the required technology is a major barrier when it comes to sustainable housing delivery in developing countries. Therefore, there is a need for expository workshops on sustainable housing and the technology it involves in order to keep developers acquainted with the subject.

The high cost of delivering sustainable housing is another critical barrier against sustainable housing delivery in Nigeria. This barrier is not only peculiar to developing countries, Williams and Dair (2007) submitted that, in England, the high cost of developing sustainable housing is still a major impediment against sustainable housing success. This could imply that the high cost of delivering sustainable housing is characteristic of both developed and developing nations. The barrier is closely related to hike in the cost of importing the required technologies. Chan et al. (2018) argued that, in the developing countries, the cost of importing the needed sustainable technology is high. This is also confirmed in the present study, the findings of which compliment that of Akinshipe et al., (2019) where it was submitted that the implementation and delivery of sustainable housing in Nigeria is not cost effective. Government incentives towards cost reduction of sustainable materials need to go a long way to enhance the adoption of sustainable housing.

The lack of a financing program is another critical impediment against sustainable housing delivery in Nigeria. This could imply that there are inadequate mortgage/bank loans for housing delivery in Nigeria, as the success of sustainable housing is dependent on adequate financing. This barrier could be linked to the high cost of sustainable housing and a hike in the costs of importing the required technology. Therefore, without appropriate finances, developers would not have enough capacity to procure the necessary materials and technologies. The findings of the present study are concurrent with those of Chan et al. (2018) in Ghana, Olanipekun, (2015) in Nigeria and Enshassi and Mayer (2005), where it was concluded that there is a poor financing arrangement for the delivery of sustainable housing. Hence, this could mean that the financing schemes for sustainable housing in developing countries are in shambles.

Factor 2 - Knowledge and awareness barrier

This underlying factor constitutes four barriers, namely: the lack of education/training on sustainability, inaccessible sustainable housing delivery guidelines and methods, limited understanding on usage of traditional non-procurement methods and the lack of awareness of sustainable housing. All these identified barriers relate to issues connected with the level of knowledge and awareness combating sustainable housing delivery. The group explains 10.762% of variance. Adequate training and education on sustainability is the backbone for promoting sustainable housing delivery. On the other hand, the absence of training and education for sustainability would

create developers with poor knowledge of sustainability. The study of Shari and Soebarto (2012) noted that there is inadequate education on sustainability in developing countries, which is in agreement with the current study. Therefore, there is a need for training and promotion of education on sustainability in the universities and also regular workshops on sustainability could enhance the knowledge of developers on sustainable housing.

The lack of sustainable housing delivery methods is another major barrier against sustainable housing delivery in Nigeria. Without appropriate methods and guidelines, sustainable housing would not thrive. This was the submission of Agyemang and Morrison (2018), Czischke and van Bortel (2018) and Abraham and Gundimenda (2018), where it was stated that sustainable housing requires a laid down approach/guidelines which should be followed by professionals without which sustainable housing delivery would not come to reality. This barrier could also be connected with the fact that there is no adequate training and education which should acquaint developers with the appropriate method for sustainable housing delivery.

A limited understanding on usage of non-traditional procurement methods is another critical barrier. The modern (sustainable) procurement methods for sustainable technology and resources have a great disparity from the traditional procurement method. The modern procurement method embraces economic, social and environmental attributes during housing delivery, whereas the old procurement approach does not. The study revealed that developers have limited knowledge and know-how on the application of the modern procurement method. Therefore, there is a need to create extensive awareness on these non-traditional methods to promote sustainable housing delivery. The submission of Chan et al., (2016), where it was established that the sustainability has not been attained in in built environment as professionals have limited knowledge on the use of the modern procurement methods, is in tandem with this.

The lack of awareness on the sustainable housing benefits is another critical impediment against the adoption of sustainable housing delivery. Although the cost implication of sustainable housing is high (Chan et al., 2018; Akinshipe et al., 2019), adequate awareness and knowledge of the benefits inherent in sustainable housing delivery would trigger the embracement of sustainable housing delivery among clients and developers. Hence from this study, it was revealed that inadequate awareness of the concerned parties on the benefits of sustainable housing would stand in the way of the success of sustainable housing, which is in agreement with Chan et al. (2016); Williams and Dair (2007) and Enshassi and Mayer (2005). This barrier is closely related to the lack of education and training on sustainable housing. This means that, without adequate education and research on the benefits inherent in sustainable housing, developers would be in the dark, thus bedeviling the full adoption of sustainable housing.

Factor 3 - Policy implementation barrier

This underlying group contains four barriers, which are: the lack of information on sustainable housing technology data bases, the lack of sustainability enforcement, the lack of organization commitment and the lack of sustainable housing regulations and codes. This group explains 8.928% of total variance. The lack of information on sustainable housing technology data does not aid in the delivery of sustainable housing in Nigeria. It is obvious that information is vital to the success of any project. Based on this study, it is observed that the Nigerian housing sector has no relevant information and data on sustainable housing technology, and that this has impeded the growth and promotion of sustainable housing delivery. The result of this study confirmed those of Alam et al., (2019); Abraham and Gundimenda, (2018); Mao et al. (2015) and Enshassi and Mayer (2005), which found that, in developing countries, there is no comprehensive information on the data needed to promote sustainable housing delivery.

Another critical barrier is the lack of sustainability enforcement by the government. Government mandating sustainable housing delivery is very crucial to achieve sustainable housing. Enforcement would push developers and clients to follow laid down enactment, which would lead to the adoption of sustainable housing delivery. However, this study confirms that, in Nigeria, there is lack of enforcement to promote sustainable housing delivery. This could be linked to the poor policy implementation for sustainable housing delivery in Nigeria. The results of Karji et al., (2020) and Saleh and Alalouch (2015) also confirm that there is no enforcement for sustainable housing, thus leading to developer housing that is below standards.

Lack of organization commitment is another critical barrier against sustainable development. The

commitment of organizations concerned with housing delivery is very crucial to promoting sustainable housing. This study, therefore, revealed that the level of commitment of organizations (real estate developers' association) concerned with housing in regards to housing sustainability is very poor. This will, however, leave housing delivery from growing from bad to worse. This is also supported by the study Shari and Soebarto (2012).

The lack of sustainable housing regulations and codes is impedance against implementation of sustainable housing. Policies and regulations are very crucial for enhancing sustainable housing. With Nigeria at the infancy state in sustainable housing, appropriate policies and regulations are imperative for its embracement among construction professionals and the public. Therefore, in Nigeria housing, there is a scarcity of polices and regulations to support the adoption and implementation of sustainable housing delivery, thereby leading to developments below the sustainability requirement. This result is in agreement with Alam et al., (2019); Love et al. (2012); Winston (2010); Enshassi and Mayer (2005), that sustainable housing has not seen the light of the day due to the lack of sustainable housing codes, policies and regulations. Hence, the immaturity state of sustainable housing delivery in Nigeria call for the enactment of relevant polices and regulations to guide and support the adoption of sustainable housing.

Factor 4 - Fear and risk barrier

This underlying factor explains 7.698% of the total variance and contains two barriers, which are: fear and risk in the adoption of new technology and the lack of a demonstrated housing project. The fear and risk of adopting a new technology is a critical barrier against sustainable housing delivery in Nigeria. With Nigeria in its infancy stage of sustainable housing, it is not exactly easy to persuade the public and clients to embrace sustainable housing due to the uncertainty in the expected performance of the new technology. This uncertainty would thus create fear in the mind of clients, as the technology is new. The findings of Chan et al. (2018); Syed Jamaludin et al. (2017); Enshassi and Mayer (2005) all support the finding of the current study that clients are always uncertain of the efficacy of new technology for promoting sustainable housing, thus creating fear in their minds.

The lack of a demonstrated sustainable project is a major barrier affecting sustainable housing delivery, which reveals the preliminary stage of sustainable housing in Nigeria. Without a notable sustainable project to demonstrate the performance of sustainable housing, it will not yield full adoption. This is the case in the present study, where there exist limited or no projects to demonstrate sustainable housing. This could lead to fear in the minds of clients in terms of adopting sustainable housing, as there exists no project to demonstrate its performance. The submission of Chan et al. (2016) is in agreement with the findings of this present study, expressing that green building development has not been implemented in Ghana due to the lack of projects to illustrate its performance.

Factor 5 - Client/Human barrier

This group explains 6.470% of variance. It contains two critical barriers, namely: unwillingness of client to pay additional construction costs and the lack of client's interest. The unwillingness of client to pay additional construction cost is another critical barrier. The willingness of clients to pay for the cost of sustainable housing would motivate developers during delivery. The present study revealed that clients are not ready to pay additional cost so as to ensure that housing delivered to them is sustainable. This could be as a result of the lack of client's interest in sustainable housing. Therefore, the current study affirmed that clients are not ready to pay extra costs for sustainable housing which is in tandem with Hasan and Zhang (2016) in China

The lack of clients' interest is a critical barrier against sustainable housing delivery in Nigeria. The interest of clients in sustainable housing is a major factor promoting sustainability. The present study, however, revealed that developers are in a market where there is no demand for sustainable housing due to lack of client's interest. This was the submission of Akinshipe et al. (2019), who stated that the lack of interest among clients is a major threat against sustainable housing delivery in Nigeria. Chan et al. (2018) also revealed that the promotion of a green building in a developing country has been bedeviled with the lack of interest from clients. The viability of any development is tied to the expected demand from the client. Sustainable housing development would only be feasible to implement when there is adequate demand for it.

Factor 6 - Economic barrier

This underlying group explains 6.132% of variance and constitutes two critical barriers, namely: logistics involved in importing the required technology, and the lack of government participation and incentive. Logistic involved in importing the required technology is a critical barrier against sustainable housing. Importation of the required technology for sustainable housing has not been favored by the economic situation of Nigeria, due to various logistics and bottlenecks. The careful organization of importation of the required technology is necessary for the successful delivery of sustainable housing in Nigeria. This is in agreement with Chan et al., (2016), who found that the complex logistics involved in importing sustainable technology is high, thus affecting sustainable housing promotion.

The lack of government participation and incentive is another critical barrier which belongs to a group with the least factor loading, although, from Table 3, it is the most critical barrier among others. Without incentive from the government and its participation, developers would find it difficult to adopt sustainable housing delivery. The Nigerian economy has not supported sustainable housing delivery, as there exists no incentive by the government to inform on loan and supply of appropriate materials. With the preliminary stage of sustainable housing in developing countries, Nigeria included (Adabre & Chan, 2019), government support and incentives are needed in order to a bring sustainably built environment into limelight. The present research therefore confirms that there is limited participation of the government and a lack of incentive to support sustainable housing in Nigeria, which is in agreement with Adabre et al., (2020); Alam et al., (2019); Chan et al. (2009) and Williams and Dair (2007).

5. Conclusion

The adoption of sustainable housing delivery in Nigeria has been hampered with myriads of barriers. These barriers call for investigation to promote the implementation of sustainability in the Nigerian construction sector. This study therefore explored the barriers against attaining sustainability in housing delivery in Lagos, Nigeria. A questionnaire was administered to developers on the subject matter and analyzed using the mean score technique and factor analysis. The findings of the study revealed that all of the 18 identified barriers are critical to sustainable housing.

The top rated three critical barriers include inadequate government participation and incentive, the lack of sustainability enforcement and the lack of information on sustainable building technology. The results of factor analysis grouped the 18 barriers into six related barriers. They include technology and costs, knowledge and awareness, policy implementation, and the client/human and economic barrier. The study concluded that these barriers affect sustainable housing delivery. In the study area, it could be observed that poor sustainable technology and its cost implications are the major stumbling block in the attainment of housing sustainability.

The results of this study have added to existing knowledge on the barriers that stand in way of sustainability attainment in housing delivery in Nigeria. They also provide a basis and blueprints for developers, practitioners and policy makers to understand these barriers, which will enable them to proffer possible ways of ameliorating them in order to promote the adoption of sustainable housing delivery. As result of the findings from this study, it is recommended that efforts be made by the policy makers and developers to mitigate the critical barriers identified in this research. Although the research aim was achieved, the study suggests that further research could be conducted using a large sample size in another area in other to compare findings. Also, the contributing effects of these barriers on sustainable housing delivery are a gap worth exploring in further research.

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